

Report on the study of the morphological composition of municipal waste in the Kherson municipality

Winter season (January 2025)

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Introduction

The scientific and technical report on the study of the composition of municipal waste (hereinafter referred to as MSW) of the Kherson municipality was prepared in accordance with the Methodological Recommendations for Determining the Morphological Composition of Municipal Waste [1].

Kherson municipality is a municipality in Ukraine, in the Kherson region with the administrative centre in the city of Kherson. The territory covers 452.769 km². The municipality consists of 16 administrative units: the city of Kherson, urban-type settlements Antonivka, Zelenivka, Komyshany, Naddnipryanske, villages of Bohdanivka, Petrivka, Sadove, Stepanivka and villages of Blahovishchenske, Zymivnyk, Inzhenerne, Molodizhne, Prydniprovske, Pryozerne, and Solnechne. The municipality has been severely affected and suffers from daily shelling by the Russian Federation. Most of the municipality is located in the Dnipro River delta and therefore was severely affected by the explosion of the Kakhovka hydroelectric power plant in June 2023.

The population of the municipality has decreased from 317.8 thousand people (January 2022, of which 279.1 thousand people lived in Kherson) to 90.9 thousand people (May 2024, of which 70.9 thousand people lived in Kherson). The population is unstable and highly dependent on the security situation. Statistics are not updated due to martial law.

The Kherson City Military Administration provided a table with information on the number of residents by administrative units (Annex 1), but there is no data on the ratio of residents in multi-apartment and single-family housing, so we did not use the appropriate weighting factors to adjust the results. Therefore, the composition of municipal waste for Kherson municipality was calculated as an arithmetic mean.

When conducting the study of the composition of municipal waste and preparing this report, the requirements of the Terms of Reference for the development of a report on the determination of the morphological composition of municipal waste in the territory of the Kherson municipality were taken into account in accordance with the Agreement No. 07/30/08/2024 between the NGO "Zero Waste Alliance Ukraine", EDRPOU code 42830021, represented by Sidorenko Sofia-Yulia Anatolievna, acting on the basis of the Charter - the "Customer", and the individual entrepreneur Kovalenko Victoria Viktorovna, EDRPOU code 3283600308 - the "Contractor".

The purpose of this study is to obtain baseline data on the morphological composition of municipal waste to improve the efficiency of its management in the Kherson municipality.

1. Description of the research methodology

In accordance with the Methodological Recommendations for Determining the Morphological Composition of municipal Waste [1], a special commission was created with representatives of the relevant structural units of local governments and/or their executive bodies, waste management service providers, business entities operating in the field of municipal waste management in the territory of the Kherson municipality to organize the study to determine the morphological composition of municipal waste.

The morphological composition of municipal waste was determined by three sources of its generation:

- 1) households - apartment buildings;
- 2) households - single-family residential buildings;
- 3) Other sources of municipal waste generation (enterprises, institutions and organizations).

According to the Terms of Reference, the morphological composition of municipal waste is planned to be determined during 4 seasons of 2024 -2025.

The morphological composition of municipal waste is determined by classification (Annex 3).

The morphological composition of municipal waste was determined by:

- 1) removal of municipal waste from containers from specially selected routes (Annex 4);
- 2) collection and transportation of municipal waste by special-purpose vehicles for the collection and transportation of the respective type of municipal waste (hereinafter referred to as garbage trucks) without their forced compaction;
- 3) employees (hereinafter referred to as sorters) trained and instructed (Annex 5) were involved in the study to determine the morphological composition of municipal waste;
- 4) the morphological composition of municipal waste was determined in accordance with Section II of the Methodological Recommendations for Determining the Morphological Composition of Municipal Waste [1], collected and transported by garbage trucks.

Since waste in the Kherson municipality is currently collected according to a certain schedule, the study was conducted:

- 1) on Route 1 "Multi-apartment residential buildings" - 2070 kg of municipal waste was collected for the period 18.01.2025-21.01.2025 (4 days). The analysis was carried out on 01/22/2025;
- 2) on Route 2 "Single-family residential buildings" - 6170 kg of municipal waste was collected for the period 16.01.2025-22.01.2025 (7 days). The analysis was carried out on January 23, 2025;
- 3) on Route 3 "Other sources of municipal waste generation: enterprises, institutions and organizations" - 2060 kg of municipal waste for the period 14.01.2025-20.01.2025 (7 days). The analysis was carried out on January 21, 2025.

The study was conducted by 3 sorters with whom the CPA contracts were signed.

The study was conducted in the following order:

- 1) Prior to the study, a briefing on occupational safety and health and work under martial law was conducted for municipal waste sorters (Annex 5) directly on the territory of the municipal waste treatment facility - 120 Raketna St., Kherson, municipal landfill (landfill);
- 2) Before the study, each sorter was given plastic bags for separate collection of certain or several types (their components) of municipal waste;
- 3) A separate site was allocated for research on the territory of the municipal waste treatment facility;
- 4) the garbage truck with municipal waste was checked for radioactive contamination and weighed on truck scales installed at the municipal waste treatment facility with a discreteness of up to 10 kg and a weighing error of no more than $0.5 \pm 1\%$, and the weight was entered into Excel tables.
- 5) the garbage truck was unloaded at a designated site and the total amount of unloaded municipal waste was selected with shovels:
 - 30 samples weighing 10 kg each for municipal waste from households - "multi-apartment residential buildings". The analysis was carried out on January 22, 2025.
 - 30 samples weighing 10 kg each for municipal waste from households - "single-family residential buildings". The analysis was carried out on January 23, 2025.
 - 15 samples weighing 10 kg each for municipal waste from other sources of municipal waste generation. The analysis was carried out on January 21, 2025.

Each sample was transferred to a sorting table for further separation into separate types (their components) of municipal waste, and the remaining municipal waste from the sample was removed from the site;

6) Each municipal waste sorter collected several types of municipal waste in containers of different sizes (plastic containers, bags, sacks or beggars). The containers were filled manually. After the selection of certain types (or components thereof) of municipal waste was completed, the residues that could not be sorted were loaded into bags.

7) The volume of containers with the selected types of municipal waste, as well as the remaining waste, was weighed and measured in turn. The results of each measurement were entered into Excel spreadsheets. The selection of individual components of municipal waste and their measurement was accompanied by photographic documentation and attached to the report.

The morphological composition of municipal waste should be determined by weighing dry waste. However, in Ukraine, there is currently virtually no access to large dewatering facilities. Therefore, untreated wet waste was used for the analysis.

Errors that need to be taken into account during the study

The morphological composition of waste on Monday will differ from the composition of waste on other days of the week (weekend effect).

The morphological composition of waste will be different during school holidays and the morning after holidays. Accordingly, samples are not collected during school holidays (during the school year) or weeks with holidays.

But this is irrelevant to the current situation in Kherson.

1.1. Selection of routes for municipal waste collection

The routes were selected to cover: multi-apartment residential buildings - Route 1, single-family residential buildings - Route 2, and other sources of municipal waste generation (enterprises, institutions and organizations) - Route 3 (Annex 4).

1.2. Territory and premises for research

To conduct the study, a specially equipped room was provided to ensure safe working conditions during the work and to comply with labour protection regulations. The premises at 120 Raketna St., Kherson, a municipal solid waste landfill, are equipped with electricity for lighting, water for washing hands and containers, and heating.

It is very important to have good lighting conditions during sorting. The illumination on the table should be ≥ 300 lux (1 lux is 1 lm/m²). This means that if the sorting takes place with inadequate basic lighting, then additional lighting must be provided: in our case, two LED lamps of 50 W each, 4000 lm each.

Since the weather was warm and rainless, part of the study was conducted outside on a durable film.

Military risks were taken into account:

- in case of shelling, the nearest shelter is located on the territory of the training ground;
- in case of a power outage, reports were printed out (Annex 3);
- The scales were charged, and a connection to a generator was provided.

1.3. Equipment and inventory

The equipment and supplies used for transportation, sorting, research and processing of the results are presented in Annex 6. All equipment and supplies were purchased prior to the start of the first phase and will be purchased as needed before each phase. Any equipment that can be reused will be reused to reduce waste generation and to comply with the principle of resource efficiency.

1.4. Training program for sorters

Prior to the study, a safety briefing was conducted for municipal waste sorters (Annex 5) directly on the territory of the municipal waste treatment facility - 120 Raketna St., Kherson, municipal solid waste landfill (landfill).

The training was also provided on how to identify the type of waste according to the sorting catalogue by type of municipal waste (Annex 7).

1.5. Sampling of municipal waste

In accordance with Section II of the Methodological Recommendations for Determining the Morphological Composition of Municipal Waste [1], the methodology for preparing a sample of mixed municipal waste for sampling for research:

- for multi-apartment residential buildings: for 3 days, it is recommended to collect 1000 kg (5-7 m³) daily from the garbage truck of the selected municipal waste collection route - or up to 6 containers of 1.1 m³, filled by at least 75%. Since the frequency of waste collection on the selected route is once every 4 days, we collected a total of 2070 kg of municipal waste, which is lower than the requirements of the Methodological Recommendations for Determining the Morphological Composition of municipal Waste, but the MSW was collected along the same route as during the study of the morphological composition of MSW in the autumn season of 2024, so we consider the amount of waste valid for the study. This decrease in the amount of waste, in our opinion, is due to seasonal fluctuations in the production of HW, as well as the fact that the amount of municipal waste production is currently highly dependent on the security situation. For comparison, in the autumn season, waste was collected along this route once every 3 days, and in the winter season - once every 4 days.

- for single-family residential buildings (manor-type houses): within 3 days, it is recommended to collect 1000 kg (5-7 m³) daily from the garbage truck of the selected municipal waste collection route or up to 6 containers of 1.1 m³ filled by at least 75%. Since in January 2025, the frequency of waste collection on the selected route was once every 7 days, we collected a total of 6170 kg of municipal waste, which meets the requirements of the Guidelines for determining the morphological composition of municipal waste. However, this route also saw a decrease in the amount of waste collected, which we believe is due to seasonal fluctuations in the generation of solid waste, as well as the fact that the amount of municipal waste generation is currently highly dependent on the security situation. For comparison, in the autumn season, waste was collected along this route once every 4 days, and in the winter season - once every 7 days.

- for other sources of municipal waste generation: it is recommended to collect 500 kg (2.5-3.5 m³) or up to 3 containers of 1.1 m³ filled by at least 75% from the garbage truck of the selected municipal waste collection route within 3 days. Since the frequency of waste collection on the selected route is once every 7 days, we collected a total of 2060 kg of municipal waste, which meets the requirements. There was no decrease in the amount of waste collected on this route.

The sampling methodology for the study of the morphological composition of mixed municipal waste included:

- for multi-apartment residential buildings: from the corresponding sample of mixed municipal waste obtained, select 30 samples weighing at least 10 kg each with shovels. A total of 300 kg of municipal waste;
- for single-family residential buildings (manor-type houses): from the corresponding sample of mixed municipal waste obtained, select 30 samples weighing at least 10 kg each with shovels. The total sample is 300 kg of municipal waste;
- for other sources of municipal waste generation: from the corresponding sample of mixed municipal waste obtained, select 15 samples weighing at least 10 kg each with shovels. A total of 150 kg of municipal waste.

The team analyzed the samples using the following algorithm:

- The samples were transferred to an open area, a strong film was spread, and the samples were turned over onto it;

- containers of different volumes, with appropriate labelling of the contents, placed around the film;
- checked the cleanliness of the sorting table;
- spread the film on the table;
- checked the scales and their measurements;
- prepared a reporting statement.

Electronic scales are installed and customized. We used scales with the following characteristics:

- Maximum weight: 1000 kg;
- Minimum weight: 10 kg;
- Two clean containers of 20 and 5 litres were additionally used for packaging.

The waste was sorted and large items (larger than Ø 100 mm) were placed in the appropriate container (as is done on the sorting line). Smaller items were then sorted especially hazardous waste.

Note: after the sorter identified the garbage as medicine, it did not open the package, even if it was transparent.

When the container was filled, it was weighed and the contents were poured into a garbage bag for later disposal. The appropriate container was placed on the scales, the containers were then weighed, and the weighing results were entered into a report card.

The volumes of each type of waste were also measured and recorded in a report.

In the end, all the containers were emptied, the table was wiped down, and the room was cleaned.

The data from the reporting sheets was transferred to Excel spreadsheets.

We handed over photos and reports.

A photo report on the results of the morphological composition of municipal waste in Kherson municipality is presented in Annex 8.

2. Results of the study

The amount of municipal waste was analyzed by the main parameters: weight (kg), volume (m³), and average density (kg/m³).

The results of the study were analyzed in the following order:

- Determining the weight of municipal waste for each garbage truck as the difference between the weight of the garbage truck filled with municipal waste and the weight of the empty garbage truck;
- the weight of each sorted type (its component in the composition) of municipal waste is determined by summing up the relevant weighing data;
- the total weight of the sorted sample was determined by summing up all the data obtained during the weighing of the types (their components) of municipal waste and their residue;
- the mass of municipal waste that has been sorted is taken as 100% (by weight), the content (in %) of each type (its component in the composition) of municipal waste in a given sample is calculated;
- The volume of each sorted type (its component in the composition) of municipal waste was determined by using containers of different sizes and scientific methods;
- the total volume of the sorted sample was determined by summing up all the data obtained during the measurement of the volume of types (their components in the composition) of municipal waste and their residue;
- the volume of municipal waste that has been sorted is taken as 100% (by volume), and the content (in %) of each type (its component in the composition) of municipal waste in this sample is calculated;
- The average density of municipal waste in garbage trucks by type of municipal and other sources of municipal waste generation was determined;
- summarized the results by type of municipal and other sources of municipal waste generation;
- The average morphological composition of municipal waste by weight and volume received by municipal waste management facilities in garbage trucks was determined.

Based on the results of the conducted research, we calculated the arithmetic mean indicators of the morphological composition of mixed municipal waste generated in the Kherson municipality.

Let's look at the results in more detail.

2.1. Research results: apartment buildings

Route 1 "Multi-apartment residential buildings", 2070 kg were collected for the period 18.01.2025-21.01.2025 (4 days), sample 300 kg, sample volume 7.18 m³. The analysis was carried out on 01/22/2025. According to the calculations, the main fractions by weight are (Fig. 2.1, Table 2.1):

- recycled materials account for 45.57%: paper and cardboard - 20.03%, certain types of plastic - 16.2% (bottles labelled PET-1 - 11.6%, bottles labelled HDPE-2 - 1.87%, plastic packaging labelled LDPE-4 (film) - 2.73%), glass - 5.87%, Tetra Pak packaging (mostly disposable "paper" cups that actually contain a layer of the film) - 1.27%, ferrous metal

packaging (cans) - 0.73%, non-ferrous metal packaging (aluminium food and beverage cans) - 1.47%. In this case, there is a lot of cardboard that can be recycled.

- bio-waste (31.9%), of which green waste (fallen leaves, branches) - 26.93% - significantly prevailed over food waste (2.93%). Other biowaste (bags of feathers and animal faeces) were also found (2.03%).

- residual waste that could not be separated by 16.52%.

- waste that is not or very rarely can be recovered (recycled) 5.13%: textiles 3.2%, plastic packaging with PP-5 marking (yoghurt cups, other dairy products) 0.93%, other composite packaging (ketchup, mayonnaise, snack packaging) 0.47%, waste electrical and electronic equipment (hereinafter referred to as WEEE in the text and diagrams) 0.53%.

- hazardous waste - 0.68%: other (including medical) - 0.28%, gas cans - 0.4%. Although hazardous waste typically accounts for up to 1% of municipal waste, its separate collection is very important for protecting the environment and the health of municipality residents.

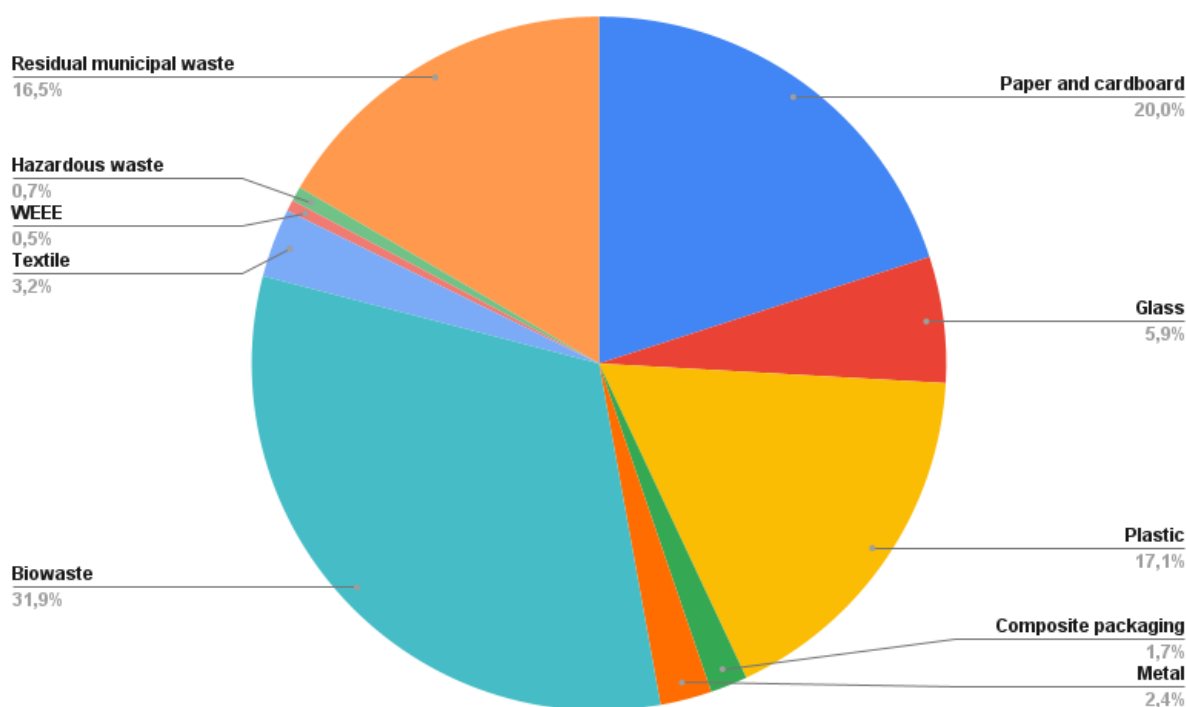


Fig. 2.1. Distribution of mixed municipal waste from multi-apartment residential buildings in Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are (Fig. 2.2, Table 2.1):

- plastic 31.04%, and the plastic that is subject to recovery (recycling) is 27.98% (bottles labelled PET-1 - 23.11%, bottles labelled HDPE-2 - 1.67%, plastic packaging labelled LDPE-4 (film) - 3.2%). That is, bottles labelled PET-1 actually take up 1/4 of the tank. If they are collected separately, the municipality can significantly save on the transportation of municipal waste. Moreover, even if a separate collection is organized, residents need to develop a culture of squeezing empty bottles to avoid transporting air. Plastic waste that cannot or very rarely can be

recovered (recycled) 3.06%, in this case, plastic packaging with PP-5 labelling (yoghurt cups, other dairy products) - 3.06%.

- other recyclables account for 32.56%: paper and cardboard - 27.42%, glass - 1.39%, Tetra Pak packaging (mostly disposable "paper" cups that actually contain a layer of film) - 0.97%, ferrous metal packaging (cans) - 1.11%, non-ferrous metal packaging (aluminium food and beverage cans) - 1.67%. In this case, there is a lot of cardboard, which is not only recyclable but also takes up more than ¼ of the tank.

- biowaste - 24.51%, of which green waste (fallen leaves, branches) - 23.11% prevailed over food waste - 0.84%. Other bio-waste was also found (bags with feathers and animal faeces) - 0.56%.

- other waste that cannot or very rarely can be recovered (recycled) 8.25%: textiles 3.48%, other composite packaging (ketchup, mayonnaise, snack packs) 4.45%, waste electrical and electronic equipment 0.32%.

- residual waste that could not be separated - 3.34%.

- hazardous waste - 0.28%.

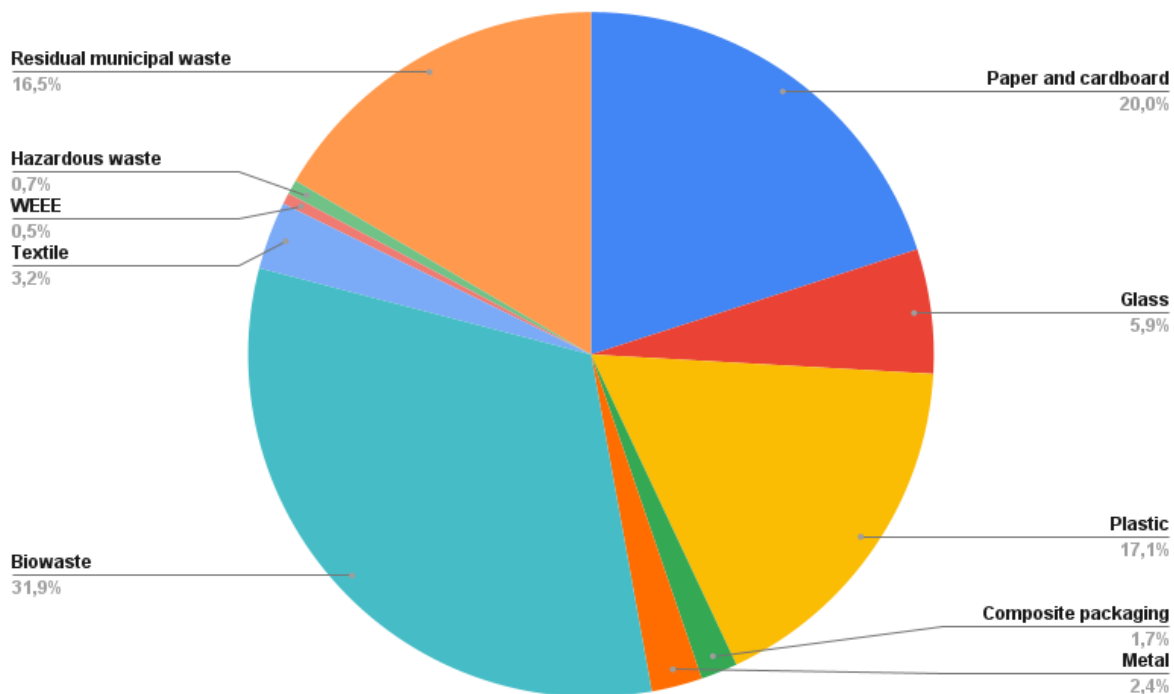


Fig. 2.2. Distribution of mixed municipal waste from multi-apartment residential buildings in Kherson municipality in % of the total sample volume

Table 2.1. The results of the study of the morphological composition of the MW of multi-apartment residential buildings in the Kherson municipality, winter season, 2025

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
1.	Paper and cardboard	60,10	20,03	1,97	27,42	30,51
1.1.	Paper packaging	0,00	0,00	0,00	0,00	0,00
1.2.	Flat cardboard packaging	50,80	16,93	1,66	23,11	30,60
1.3.	Cardboard (corrugated)	5,20	1,73	0,25	3,48	20,80
1.4.	Office paper	0,00	0,00	0,00	0,00	0,00
1.5.	Other paper	3,70	1,23	0,04	0,56	92,50
1.6.	Other cardboard	0,40	0,13	0,02	0,28	20,00
2.	Glass	17,60	5,87	0,10	1,39	176,00
2.1.	Transparent glass packaging	9,60	3,20	0,05	0,70	192,00
2.2.	Colored glass packaging	8,00	2,67	0,05	0,70	160,00
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.5.	Other glass	0,00	0,00	0,00	0,00	0,00
3.	Plastic	51,40	17,13	2,23	31,04	23,05
3.1.	Bottles with PET-1 labeling	34,80	11,60	1,66	23,11	20,96
3.2.	Plastic packaging with PET-1 marking	0,00	0,00	0,00	0,00	0,00
3.3.	Bottles labeled with HDPE-2	5,60	1,87	0,12	1,67	46,67
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging labeled LDPE-4	8,20	2,73	0,23	3,20	35,65
3.6.	Plastic packaging with PP-5 marking	2,80	0,93	0,22	3,06	12,73

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
3.7.	Plastic packaging with PS-6 marking	0,00	0,00	0,00	0,00	0,00
3.8.	Plastic with marking 7	0,00	0,00	0,00	0,00	0,00
3.9.	Other plastic packaging without labeling	0,00	0,00	0,00	0,00	0,00
3.10.	Other plastics	0,00	0,00	0,00	0,00	0,00
4.	Composite packaging	5,20	1,73	0,39	5,43	13,33
4.1.	Tetra pack type packaging	3,80	1,27	0,07	0,97	54,29
4.2.	Other composite packaging	1,40	0,47	0,32	4,45	4,38
5.	Metals	7,20	2,40	0,20	2,79	35,91
5.1.	Packaging (containers) made of ferrous metals	2,20	0,73	0,08	1,11	27,50
5.2.	Packaging (containers) made of aluminum	4,40	1,47	0,12	1,67	36,67
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	0,60	0,20	0,00	0,01	1200,00
6.	Biowaste	95,70	31,90	1,76	24,50	54,38
6.1.	Food waste	8,80	2,93	0,06	0,84	146,67
6.2.	Waste from green spaces	80,80	26,93	1,66	23,11	48,67
6.3.	Other biodegradable waste	6,10	2,03	0,04	0,56	152,50
7.	Wood	0,00	0,00	0,00	0,00	0,00
8.	Textiles	9,60	3,20	0,25	3,48	38,40
8.1.	Clothing and footwear	4,80	1,60	0,12	1,67	40,00
8.2.	Other textile materials	4,80	1,60	0,13	1,81	36,92
9.	Waste electrical and electronic equipment	1,60	0,53	0,02	0,32	69,57
9.1.	Small municipal appliances and parts	1,60	0,53	0,02	0,32	69,57

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
9.2.	Computer equipment	0,00	0,00	0,00	0,00	0,00
9.3.	Televisions and other devices containing a cathode ray tube	0,00	0,00	0,00	0,00	0,00
9.4.	Lamps with low energy consumption	0,00	0,00	0,00	0,00	0,00
10.	Waste batteries and accumulators	0,00	0,00	0,00	0,00	0,00
11.	Hazardous waste	2,03	0,68	0,02	0,28	101,26
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00
11.2.	Unused medicines and their packaging	0,80	0,27	0,01	0,14	80,00
11.3.	Syringes	0,03	0,01	0,00	0,00	0,00
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	1,20	0,40	0,01	0,14	120,00
11.6.	Paint	0,00	0,00	0,00	0,00	0,00
11.7.	Other hazardous waste	0,00	0,00	0,00	0,00	0,00
12.	Bulky municipal waste	0,00	0,00	0,00	0,00	0,00
13.	Municipal C&D waste	0,00	0,00	0,00	0,00	0,00
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Lumber	0,00	0,00	0,00	0,00	0,00
13.4.	Drywall	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	Residual municipal waste	49,57	16,52	0,24	3,34	206,54
15.	Total	300,00	100,00	7,18	100,00	41,76

2.2. Research results: single-family residential buildings

Route 2 "Single-family residential buildings", 6170 kg were collected for the period 16.01.2025-22.01.2025 (7 days), sample 300 kg, sample volume 4.86 m³. The analysis was carried out on January 23, 2025.

According to the calculations, the main fractions by weight are as follows (Fig. 2.3, Table 2.2):

- residual waste that could not be separated - 32.92%, i.e. the waste was highly contaminated.

- recyclable materials account for 31.84%: paper and cardboard - 15.19%, certain types of plastic - 7.92% (bottles labelled PET-1 - 4.05%, bottles labelled HDPE-2 - 1.67%, plastic packaging labelled LDPE-4 (film) - 2.2%), glass - 4.73%, Tetra Pak packaging (mostly disposable "paper" cups that actually contain a layer of the film) - 1.2%, ferrous metal packaging (cans) - 1.0%, non-ferrous metal packaging (aluminium food and beverage cans) - 1.8%. In this case, there is a lot of cardboard that can be recycled.

- biowaste 27.1%, of which green waste (fallen leaves, branches) - 21.37% significantly prevails over food waste - 3.13%. Other bio-waste (dead goose and animal faeces) was also found - 2.53%, wood - 0.07%.

- waste that is not or very rarely subject to recovery (recycling) 7.01%: textiles - 2.47%, plastic packaging with PP-5 marking (yoghurt cups, other dairy products) - 0.33%, other plastic packaging (including vacuum packaging) and unmarked plastic (including children's toys) - 0.47%, other plastic - 1.47%, other composite packaging (ketchup and mayonnaise doy-packs) - 1.87%, waste electrical and electronic equipment - 0.4%.

- hazardous waste - 1.15%: waste batteries and accumulators (0.07%), other (including medical).

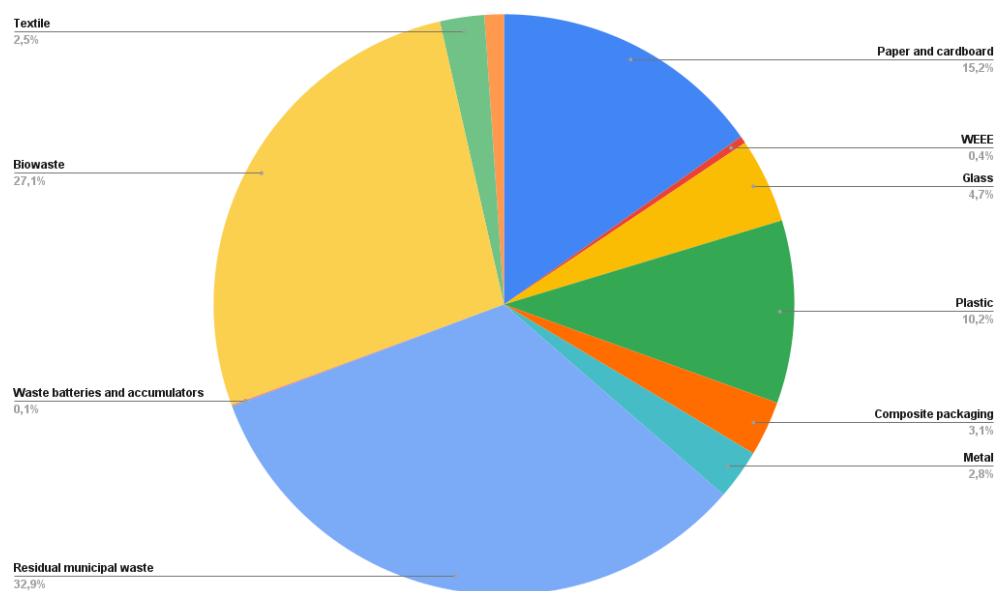


Fig. 2.3. Distribution of mixed municipal waste from single-family residential buildings in Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are (Fig. 2.4, Table 2.2):

- biowaste 36.09%, of which green waste (fallen leaves, branches) - 34.13% significantly prevail over food waste - 0.82%. Other biowaste was also found (dead goose and animal faeces) - 1.11%, wood - 0.02%.
- plastic - 24.8%, of which 17.69% is recoverable (recyclable) (bottles with PET-1 labeling - 12.34%, bottles with HDPE-2 labelling - 2.06%, plastic packaging with LDPE-4 labeling (film) - 3.29%). Plastic waste that is not or very rarely subject to recovery (recycling) - 7.11%: plastic packaging with PP-5 marking (yoghurt cups, other dairy products) - 2.47%, other plastic packaging and unmarked plastic (including children's toys) - 4.11%, other plastic - 0.53%.
- other recyclables account for 22.84%: paper and cardboard - 14.41%, Tetra Pak packaging (mostly disposable "paper" cups that actually contain a layer of the film) - 2.47%, ferrous metal packaging (cans) - 1.64%, non-ferrous metal packaging (aluminium food and beverage cans) - 2.88%, and glass - 1.44%. In this case, there is a lot of cardboard that can be recycled.
- other waste that cannot or very rarely can be recovered (recycled) - 9.48%: textiles - 3.29%, other composite packaging (doy-pack for ketchup, mayonnaise, snack packaging) - 5.98%, WEEE - 0.21%.
- residual waste that could not be separated - 6.17%.
- hazardous waste - 0.62%.

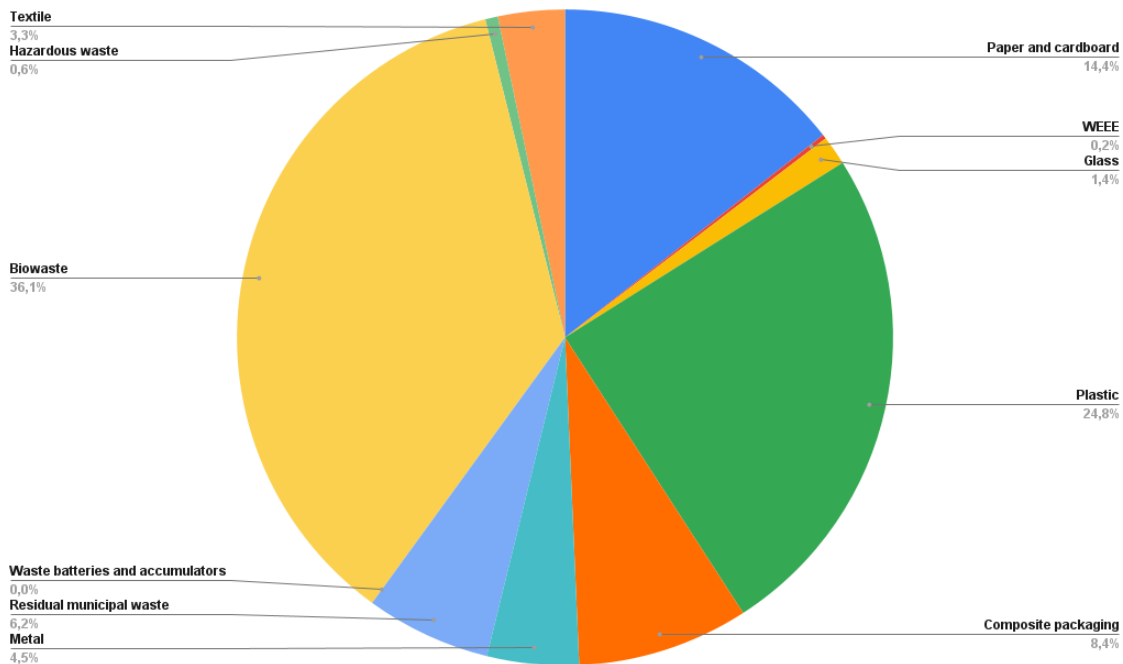


Fig. 2.4. Distribution of mixed municipal waste from single-family residential buildings in Kherson municipality in % of the total sample volume

Table 2.2. The results of the study of the morphological composition of single-family residential buildings in Kherson municipality winter season, 2025

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
1.	Paper and cardboard	45,56	15,19	0,70	14,41	64,99
1.1.	Paper packaging	3,56	1,19	0,03	0,62	118,67
1.2.	Flat cardboard packaging	21,70	7,23	0,10	2,06	217,00
1.3.	Cardboard (corrugated)	9,80	3,27	0,05	1,03	196,00
1.4.	Office paper	9,00	3,00	0,12	2,47	75,00
1.5.	Other paper	0,10	0,03	0,00	0,02	100,00
1.6.	Other cardboard	1,40	0,47	0,40	8,22	3,50
2.	Glass	14,20	4,73	0,07	1,44	202,86
2.1.	Transparent glass packaging	6,80	2,27	0,03	0,62	226,67
2.2.	Colored glass packaging	7,40	2,47	0,04	0,82	185,00
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.5.	Other glass	0,00	0,00	0,00	0,00	0,00
3.	Plastic	30,54	10,18	1,21	24,80	25,32
3.1.	Bottles with PET-1 labeling	12,14	4,05	0,60	12,34	20,23
3.2.	Plastic packaging with PET-1 marking	0,00	0,00	0,00	0,00	0,00
3.3.	Bottles labeled with HDPE-2	5,00	1,67	0,10	2,06	50,00
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging labeled LDPE-4	6,60	2,20	0,16	3,29	41,25
3.6.	Plastic packaging with PP-5 marking	1,00	0,33	0,12	2,47	8,33

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
3.7.	Plastic packaging with PS-6 marking	0,00	0,00	0,00	0,00	0,00
3.8.	Plastic with marking 7	0,00	0,00	0,00	0,00	0,00
3.9.	Other plastic packaging without labeling	1,40	0,47	0,20	4,11	7,00
3.10.	Other plastics	4,40	1,47	0,03	0,53	169,23
4.	Composite packaging	9,20	3,07	0,41	8,45	22,38
4.1.	Tetra pack type packaging	3,60	1,20	0,12	2,47	30,00
4.2.	Other composite packaging	5,60	1,87	0,29	5,98	19,24
5.	Metals	8,40	2,80	0,22	4,52	38,18
5.1.	Packaging (containers) made of ferrous metals	3,00	1,00	0,08	1,64	37,50
5.2.	Packaging (containers) made of aluminum	5,40	1,80	0,14	2,88	38,57
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	0,00	0,00	0,00	0,00	0,00
6.	Biowaste	81,10	27,03	1,75	36,07	46,24
6.1.	Food waste	9,40	3,13	0,04	0,82	235,00
6.2.	Waste from green spaces	64,10	21,37	1,66	34,13	38,61
6.3.	Other biodegradable waste	7,60	2,53	0,05	1,11	140,74
7.	Wood	0,20	0,07	0,00	0,02	200,00
8.	Textiles	7,40	2,47	0,16	3,29	46,25
8.1.	Clothing and footwear	6,20	2,07	0,15	3,08	41,33
8.2.	Other textile materials	1,20	0,40	0,01	0,21	120,00
9.	Waste electrical and electronic equipment	1,20	0,40	0,01	0,21	120,00
9.1.	Small municipal appliances and parts	1,20	0,40	0,01	0,21	120,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
9.2.	Computer equipment	0,00	0,00	0,00	0,00	0,00
9.3.	Televisions and other devices containing a cathode ray tube	0,00	0,00	0,00	0,00	0,00
9.4.	Lamps with low energy consumption	0,00	0,00	0,00	0,00	0,00
10.	Waste batteries and accumulators	0,20	0,07	0,00	0,00	4444,44
11.	Hazardous waste	3,25	1,08	0,03	0,62	106,84
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00
11.2.	Unused medicines and their packaging	2,20	0,73	0,02	0,41	110,00
11.3.	Syringes	0,05	0,02	0,00	0,00	625,00
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	1,00	0,33	0,01	0,21	100,00
11.6.	Paint	0,00	0,00	0,00	0,00	0,00
11.7.	Other hazardous waste	0,00	0,00	0,00	0,00	0,00
12.	Bulky municipal waste	0,00	0,00	0,00	0,00	0,00
13.	Municipal C&D waste	0,00	0,00	0,00	0,00	0,00
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Lumber	0,00	0,00	0,00	0,00	0,00
13.4.	Drywall	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	Residual municipal waste	98,75	32,92	0,30	6,17	329,17
15.	Total	300,00	100,00	4,86	100,00	61,68

2.3. Research results: other sources of municipal waste generation

Route 3 "Other sources of municipal waste generation: enterprises, institutions and organizations", 2060 kg were collected for the period 14.01.2025-20.01.2025 (7 days), so the sample is 150 kg, the sample volume is 6.22 m³. The analysis was carried out on January 21, 2025.

According to the calculations, the main fractions by weight are (Fig. 2.5, Table 2.3):

- recycled materials account for 48.54%: Certain types of plastic - 18.81% (bottles labelled PET-1 - 9.87%, bottles labelled HDPE-2 - 7.47%, plastic packaging labelled LDPE-4 (film) - 1.47%), paper and cardboard - 14.53%, glass - 9.6%, Tetra Pak packaging (mostly disposable "paper" cups that actually contain a layer of film) - 1.33%, ferrous metal packaging - 1.47%, non-ferrous metal packaging (aluminium food and beverage cans) - 2.8%. In this case, there is a lot of cardboard that can be recycled.

- bio-waste - 30.87%, including green waste (fallen leaves, branches) - 25.93%, food waste - 2.53%, and wood - 2.4%.

- waste that cannot or very rarely can be recovered (recycled) - 11.07%: textiles - 6.13%, other composite packaging (ketchup, mayonnaise, snack containers) - 1.47%, waste electrical and electronic equipment - 3.47%.

- residual waste that could not be separated - 7.79%.

- hazardous waste - 1.74%. Hazardous waste on this route makes up the largest share of municipal waste among the 3 routes.

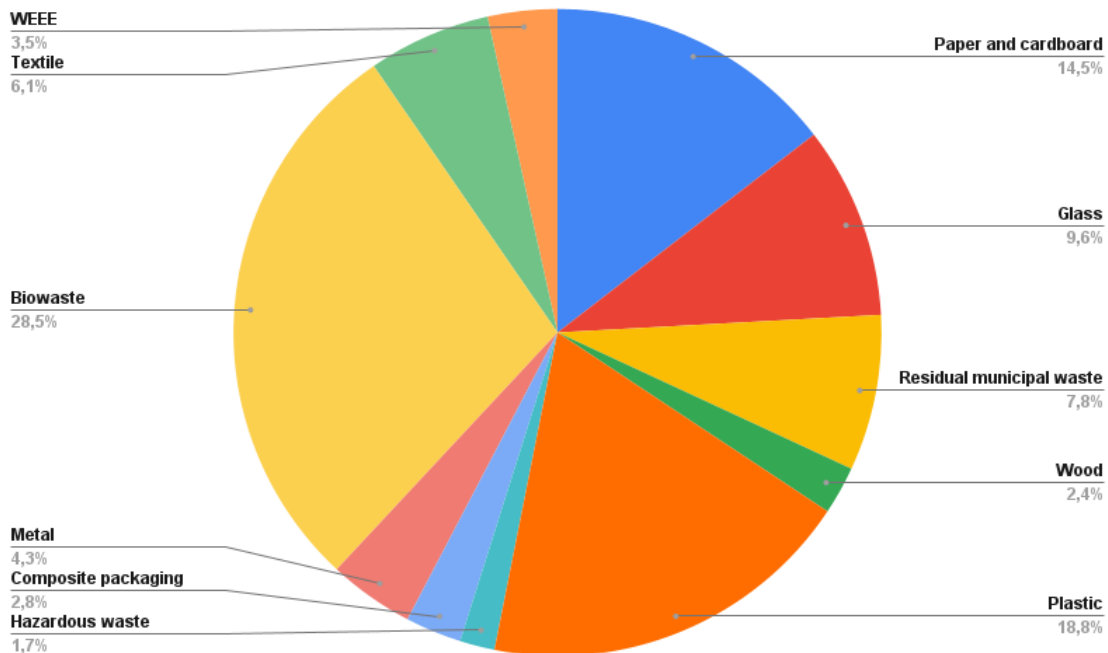


Fig. 2.5. Distribution of mixed municipal waste from the route "Other sources of municipal waste generation: enterprises, institutions and organizations" of Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are (Fig. 2.6, Table 2.3):

- other recyclables account for 32.29%: paper and cardboard - 27.15%, Tetra Pak packaging (mostly disposable "paper" cups that actually contain a layer of the film) - 1.45%, ferrous metal packaging - 0.96%, non-ferrous metal packaging (aluminium food and beverage cans, snack cans) - 1.61%, glass - 1.12%. In this case, there is a lot of cardboard, which is not only recyclable but also takes up more than ¼ of the tank.

- plastic - 32.13%, of which the plastic that can be recovered (recycled) is 32.13% (PET-1 bottles - 26.67%, HDPE-2 bottles - 2.89%, LDPE-4 plastic packaging (film) - 2.57%). That is, bottles labelled PET-1 actually take up more than ¼ of the tank. If they are collected separately, the municipality can significantly save on the transportation of municipal waste. Moreover, even if a separate collection is organized, residents need to develop a culture of squeezing empty bottles to avoid transporting air.

- bio-waste - 27.92%, including 26.64% of green waste (fallen leaves, branches), 0.64% of food waste, and 0.64% of wood.

- other waste that cannot or very rarely can be recovered (recycled) - 6.83%: textiles - 1.93%, other composite packaging (ketchup and mayonnaise doypacks) - 3.69%, waste electrical and electronic equipment - 1.21%.

- residual waste that could not be separated by 0.48%.

- hazardous waste - 0.31%.

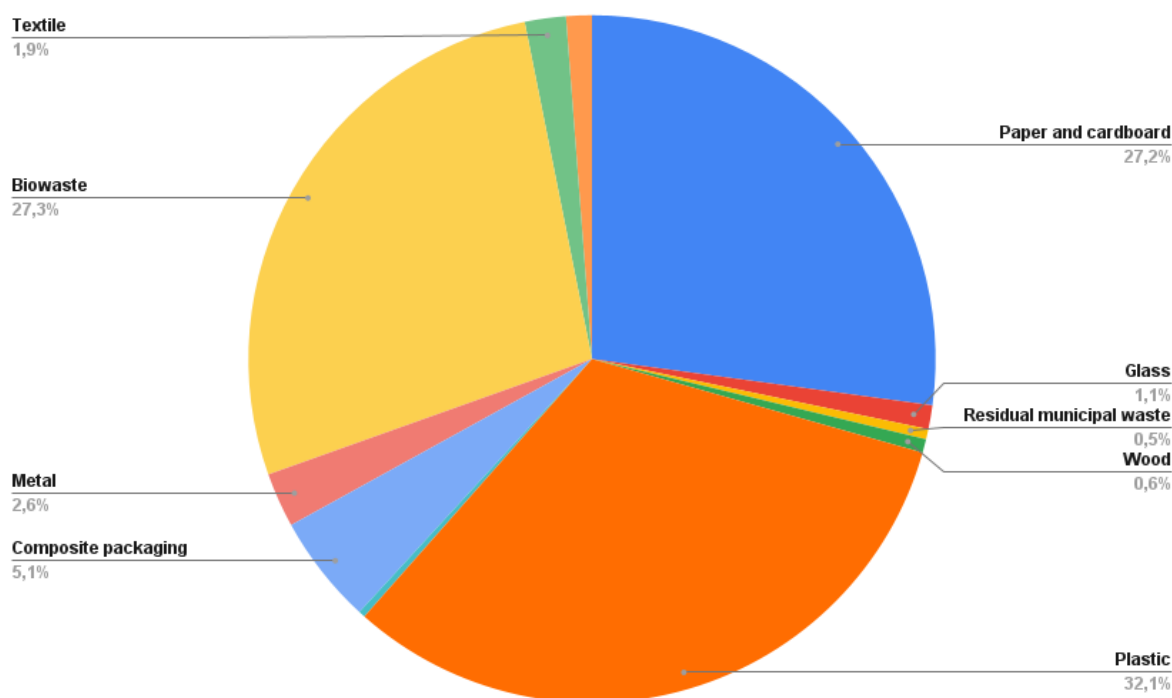


Fig. 2.6. Distribution of mixed municipal waste from the route "Other sources of municipal waste generation: enterprises, institutions and organizations" in Kherson municipality in % of the total sample volume

Table 2.3. The results of the study of the morphological composition of the route "Other sources" of the Kherson municipality, winter season, 2025

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
1.	Paper and cardboard	21,80	14,53	1,69	27,15	12,90
1.1.	Paper packaging	0,00	0,00	0,00	0,00	0,00
1.2.	Flat cardboard packaging	15,80	10,53	1,60	25,70	9,88
1.3.	Cardboard (corrugated)	0,00	0,00	0,00	0,00	0,00
1.4.	Office paper	5,80	3,87	0,07	1,12	82,86
1.5.	Other paper	0,00	0,00	0,00	0,00	0,00
1.6.	Other cardboard	0,20	0,13	0,02	0,32	0,00
2.	Glass	14,40	9,60	0,07	1,12	205,71
2.1.	Transparent glass packaging	6,40	4,27	0,04	0,64	160,00
2.2.	Colored glass packaging	8,00	5,33	0,03	0,48	266,67
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.5.	Other glass	0,00	0,00	0,00	0,00	0,00
3.	Plastic	28,20	18,80	2,00	32,13	14,10
3.1.	Bottles with PET-1 labeling	14,80	9,87	1,66	26,67	8,92
3.2.	Plastic packaging with PET-1 marking	0,00	0,00	0,00	0,00	0,00
3.3.	Bottles labeled with HDPE-2	11,20	7,47	0,18	2,89	62,22
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging labeled LDPE-4	2,20	1,47	0,16	2,57	13,75
3.6.	Plastic packaging with PP-5 marking	0,00	0,00	0,00	0,00	0,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
3.7.	Plastic packaging with PS-6 marking	0,00	0,00	0,00	0,00	0,00
3.8.	Plastic with marking 7	0,00	0,00	0,00	0,00	0,00
3.9.	Other plastic packaging without labeling	0,00	0,00	0,00	0,00	0,00
3.10.	Other plastics	0,00	0,00	0,00	0,00	0,00
4.	Composite packaging	4,20	2,80	0,32	5,14	13,13
4.1.	Tetra pack type packaging	2,00	1,33	0,09	1,45	22,22
4.2.	Other composite packaging	2,20	1,47	0,23	3,69	9,57
5.	Metals	6,40	4,27	0,16	2,57	40,00
5.1.	Packaging (containers) made of ferrous metals	2,20	1,47	0,06	0,96	36,67
5.2.	Packaging (containers) made of aluminum	4,20	2,80	0,10	1,61	42,00
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	0,00	0,00	0,00	0,00	0,00
6.	Biowaste	42,70	28,47	1,70	27,31	25,12
6.1.	Food waste	3,80	2,53	0,04	0,64	95,00
6.2.	Waste from green spaces	38,90	25,93	1,66	26,67	23,43
6.3.	Other biodegradable waste	0,00	0,00	0,00	0,00	0,00
7.	Wood	3,60	2,40	0,04	0,64	90,00
8.	Textiles	9,20	6,13	0,12	1,93	76,67
8.1.	Clothing and footwear	6,20	4,13	0,12	1,93	51,67
8.2.	Other textile materials	0,00	0,00	0,00	0,00	0,00
9.	Waste electrical and electronic equipment	5,20	3,47	0,08	1,21	69,15
9.1.	Small municipal appliances and parts	1,20	0,80	0,03	0,48	40,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
9.2.	Computer equipment	0,80	0,53	0,01	0,08	80,00
9.3.	Televisions and other devices containing a cathode ray tube	3,20	2,13	0,04	0,64	80,00
9.4.	Lamps with low energy consumption	0,00	0,00	0,00	0,00	0,00
10.	Waste batteries and accumulators	0,00	0,00	0,00	0,00	0,00
11.	Hazardous waste	2,61	1,74	0,02	0,31	133,68
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00
11.2.	Unused medicines and their packaging	1,40	0,93	0,01	0,18	127,27
11.3.	Syringes	0,00	0,00	0,00	0,00	0,00
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	0,80	0,53	0,00	0,05	266,67
11.6.	Paint	0,40	0,27	0,01	0,08	80,00
11.7.	Other hazardous waste	0,01	0,01	0,00	0,01	20,00
12.	Bulky municipal waste	0,00	0,00	0,00	0,00	0,00
13.	Municipal C&D waste	0,00	0,00	0,00	0,00	0,00
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Lumber	0,00	0,00	0,00	0,00	0,00
13.4.	Drywall	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	Residual municipal waste	11,69	7,79	0,03	0,48	389,67
15.	Total	150,00	100,00	6,22	100,00	24,10

2.4. Average indicators of municipal waste composition for the fall season

According to the calculations, the main fractions by weight are (Fig. 2.7, Table 2.4):

- recycled materials account for 40.67%: paper and cardboard - 16.99%, certain types of plastic - 13.41% (bottles labelled PET-1 - 8.23%, bottles labelled HDPE-2 - 2.91%, plastic packaging labelled LDPE-4 (film) - 2.27%), glass - 6.16%, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of the film) - 1.25%, ferrous metal packaging (cans) - 0.99%, non-ferrous metal packaging (aluminium food and beverage cans) - 1.87%. In this case, there is a lot of cardboard that can be recycled.

- bio-waste 29.78%, of which green waste (fallen leaves, branches) - 24.51% prevails over food waste - 2.93%, other biodegradable waste (dead animals, feathers, animal faeces) - 1.83%, wood - 0.51%;

- residual waste that could not be separated - 21.33%.

- waste that is not or very rarely subject to recovery (recycling) - 7.08%: textiles - 3.49%, plastic packaging with PP-5 markings (yoghurt cups, other dairy products) - 0.51%, other plastic packaging (including vacuum packaging) and unmarked plastic (including children's toys) - 0.78%, other composite packaging (ketchup, mayonnaise, snack, candy doypacks) - 1.23%, waste electrical and electronic equipment - 1.07%.

- hazardous waste - 1.08%: waste batteries and accumulators (0.03%), other (including medical). Although hazardous waste typically accounts for up to 1% of municipal waste, its separate collection is very important for protecting the environment and the health of municipality residents.

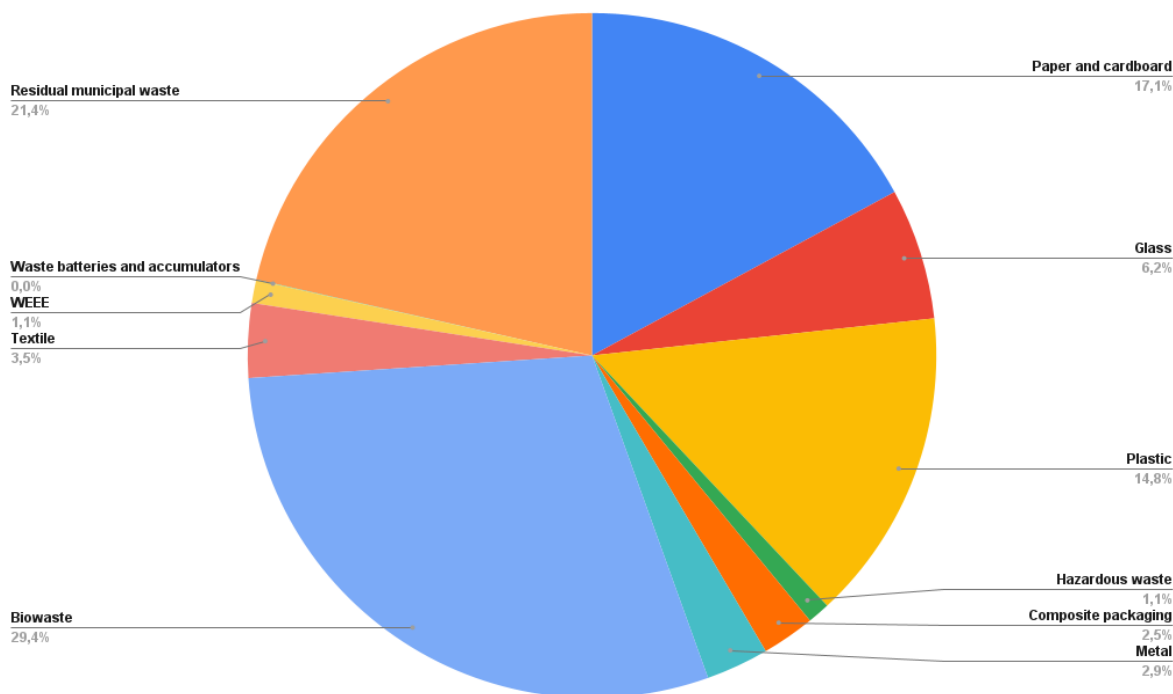


Fig. 2.7. Distribution of mixed municipal waste in Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are (Fig. 2.8, Table 2.4):

- other recyclables account for 29.88%: paper and cardboard - 23.87%, Tetra Pak packaging (mostly disposable "paper" cups that actually contain a layer of the film) - 1.53%, ferrous metal packaging (cans) - 1.2%, non-ferrous metal packaging (aluminium food and beverage cans) - 1.97%, glass - 1.31%. In this case, there is a lot of cardboard, which is not only recyclable but also takes up almost ¼ of the tank.

- plastic 29.75%, including 26.65% that can be recovered (recycled) (bottles with PET-1 labeling - 21.45%, bottles with HDPE-2 labeling - 2.19%, plastic packaging with LDPE-4 labeling (film) - 3.01%). Plastic waste that cannot or rarely can be recovered (recycled) - 3.11%: plastic packaging with PP-5 marking (yoghurt cups, other dairy products) - 1.86%, other plastic packaging and unmarked plastic (including children's toys) - 1.25%.

- bio-waste - 28.76%, of which green waste (fallen leaves, branches) - 27.26% prevails over food waste - 0.77%, other biodegradable waste (dead animals, feathers, animal faeces) - 0.51%, wood - 0.22%. Accordingly, almost ⅓ of the municipal waste by volume is green waste.

- other waste that cannot or very rarely can be recovered (recycled) - 8.06%: textiles - 2.9%, other composite packaging (ketchup, mayonnaise, snack, candy) - 4.6%, waste electrical and electronic equipment - 0.59%.

- residual waste that could not be separated - 3.12%.

- hazardous waste - 0.38%: waste batteries and accumulators, other (including medical).

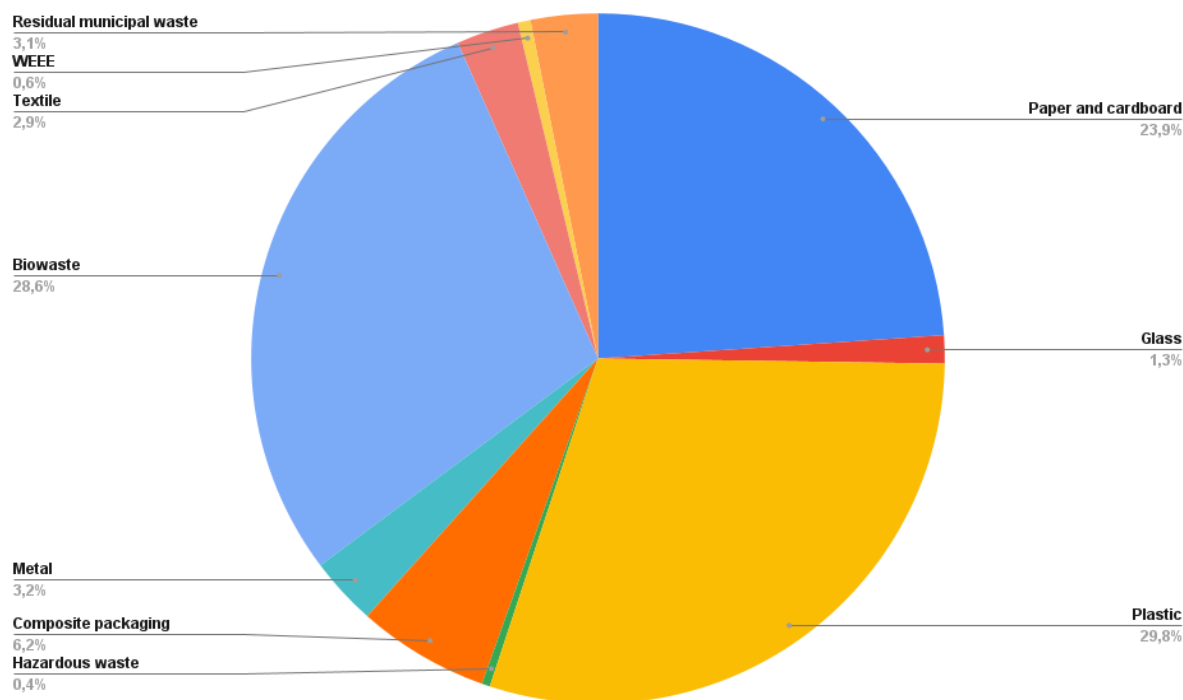


Fig. 2.8. Distribution of mixed municipal waste in Kherson municipality in % of the total sample volume

Table 2.4. Results of the study of the morphological composition of the MW average indicators for the Kherson municipality, winter season, 2025

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
1.	Paper and cardboard	127,46	16,99	4,36	23,87	29,23
1.1.	Paper packaging	3,56	0,47	0,03	0,16	118,67
1.2.	Flat cardboard packaging	88,30	11,77	3,36	18,39	26,28
1.3.	Cardboard (corrugated)	15,00	2,00	0,30	1,64	50,00
1.4.	Office paper	14,80	1,97	0,19	1,04	77,89
1.5.	Other paper	3,80	0,51	0,04	0,22	92,68
1.6.	Other cardboard	2,00	0,27	0,44	2,41	4,55
2.	Glass	46,20	6,16	0,24	1,31	192,50
2.1.	Transparent glass packaging	22,80	3,04	0,12	0,66	190,00
2.2.	Colored glass packaging	23,40	3,12	0,12	0,66	195,00
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.5.	Other glass	0,00	0,00	0,00	0,00	0,00
3.	Plastic	110,14	14,69	5,44	29,75	20,26
3.1.	Bottles with PET-1 labeling	61,74	8,23	3,92	21,45	15,75
3.2.	Plastic packaging with PET-1 marking	0,00	0,00	0,00	0,00	0,00
3.3.	Bottles labeled with HDPE-2	21,80	2,91	0,40	2,19	54,50
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging labeled LDPE-4	17,00	2,27	0,55	3,01	30,91
3.6.	Plastic packaging with PP-5 marking	3,80	0,51	0,34	1,86	11,18

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
3.7.	Plastic packaging with PS-6 marking	0,00	0,00	0,00	0,00	0,00
3.8.	Plastic with marking 7	0,00	0,00	0,00	0,00	0,00
3.9.	Other plastic packaging without labeling	1,40	0,19	0,20	1,09	7,00
3.10.	Other plastics	4,40	0,59	0,03	0,14	169,23
4.	Composite packaging	18,60	2,48	1,12	6,14	16,59
4.1.	Tetra-pack type packaging	9,40	1,25	0,28	1,53	33,57
4.2.	Other composite packaging	9,20	1,23	0,84	4,60	10,94
5.	Metals	22,00	2,93	0,58	3,18	37,90
5.1.	Packaging (containers) made of ferrous metals	7,40	0,99	0,22	1,20	33,64
5.2.	Packaging (containers) made of aluminium	14,00	1,87	0,36	1,97	38,89
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	0,60	0,08	0,00	0,00	1200,00
6.	Biowaste	219,50	29,27	5,21	28,54	42,10
6.1.	Food waste	22,00	2,93	0,14	0,77	157,14
6.2.	Waste from green spaces	183,80	24,51	4,98	27,26	36,91
6.3.	Other biodegradable waste	13,70	1,83	0,09	0,51	145,74
7.	Wood	3,80	0,51	0,04	0,22	92,68
8.	Textiles	26,20	3,49	0,53	2,90	49,43
8.1.	Clothing and footwear	17,20	2,29	0,39	2,13	44,10
8.2.	Other textile materials	6,00	0,80	0,14	0,77	42,86
9.	Waste electrical and electronic equipment	8,00	1,07	0,11	0,59	73,94
9.1.	Small municipal appliances and parts	4,00	0,53	0,06	0,34	63,49

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m ³	Composition of waste by volume, %	Density kg/m ³
9.2.	Computer equipment	0,80	0,11	0,01	0,03	160,00
9.3.	Televisions and other devices containing a cathode ray tube	3,20	0,43	0,04	0,22	80,00
9.4.	Lamps with low energy consumption	0,00	0,00	0,00	0,00	0,00
10.	Waste batteries and accumulators	0,20	0,03	0,00	0,00	3350,00
11.	Hazardous waste	7,89	1,05	0,07	0,38	112,73
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00
11.2.	Unused medicines and their packaging	4,40	0,59	0,04	0,22	107,32
11.3.	Syringes	0,08	0,01	0,00	0,00	520,83
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	3,00	0,40	0,02	0,13	130,43
11.6.	Paint	0,40	0,05	0,01	0,03	80,00
11.7.	Other hazardous waste	0,01	0,00	0,00	0,00	12,50
12.	Bulky municipal waste	0,00	0,00	0,00	0,00	0,00
13.	Municipal C&D waste	0,00	0,00	0,00	0,00	0,00
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Lumber	0,00	0,00	0,00	0,00	0,00
13.4.	Drywall	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	Residual municipal waste	160,01	21,33	0,57	3,12	280,72
15.	Total	750,00	99,99	18,27	100,00	41,05

List of references

1. Order of the Ministry of Communities, Territorial and Infrastructure Development of Ukraine No. 409 of 03.05.2024 "On Approval of Methodological Recommendations for Determining the Morphological Composition of Municipal Waste". URL: https://rada.info/upload/users_files/04388478/9920006ccaf9d75a69cb5247b8a915a9.pdf
2. Press release of the project "Best practices of bio-waste management in small municipalities of Ukraine". URL: <https://zerowaste.org.ua/2024/05/29/pres-reliz-proyektu-krashhi-praktyky-upravlinnya-bi-ovidhodamy-v-malyh-gromadah-ukrayiny/>